IV. ENVIRONMENTAL IMPACT ANALYSIS
C. GEOLOGY AND SOILS

This section of the EIR provides a discussion of the existing geologic environment of the project site and the surrounding area and an analysis of potential geologic, seismic, and soils effects associated with implementation of the proposed project.

Information for this analysis is based on a technical study entitled *Report of Geotechnical Study, Lowe's Companies, Inc., Huntington Beach, California*, prepared by Golder Associates, Inc., dated February 8, 2000. This geotechnical assessment was conducted for 11.6 acres of Area A which is located in the central portion of the project site (refer to Figure II.C-2 in Section II., Project Description, of this EIR). Because the nature of geological and soil conditions does not typically vary widely within such a confined geographic area, much of the information that applies to Area A is also applicable to Areas B1 and B2, which make up the western-most and eastern-most portions of the project site, respectively. Development associated with Area B1 has not been explicitly defined and would require site-specific investigation prior to implementation to ensure that no impacts associated with geology or soils would occur. No changes are proposed for Area B2, thus no impacts associated with that portion of the site would occur. The full text of the geotechnical report is included as Appendix C of this EIR.

1. APPLICABLE PLANS AND POLICIES

Building and construction within the City of Huntington Beach are subject to regulations within the Municipal Code which govern grading, fill, and excavation activities. Applicable regulations include the Building Code (Section 17.04), the Grading and Excavation Code (Section 17.05), and earthquake hazard regulations (Section 17.16). Seismic design criteria are contained within the Uniform Building Code (UBC). In addition, the City's General Plan includes an Environmental Hazards Element that defines goals, objectives, policies, and programs related to geologic, soils, and seismic hazards. The following goal of the Environmental Hazards Element is relevant to the project site and/or the proposed project:

> **EH 1:** Ensure that the number of deaths and injuries, levels of property damage, levels of economic and social disruption, and interruption of vital social services resulting from seismic activity and geologic hazards shall be within levels of acceptable risk.

The specific policies of the Environmental Hazards Element that are relevant to the project site and/or the proposed project include:

EH 1.2.1: Require appropriate engineering and building practices for all new structures to withstand groundshaking and liquefaction as stated in the Uniform Building Code (UBC).

EH 1.3.5: Encourage property owners to take adequate steps to protect their property against economic risks resulting from seismic and geologic hazards.

2. ENVIRONMENTAL SETTING

a. Physiography and Topography

The project site is located in the northeastern portion of the City of Huntington Beach in western Orange County, which is situated in the Los Angeles Basin of Southern California. The Basin is generally bounded by the Santa Monica Mountains on the north, the Puente Hills and the Whittier fault on the east, the Santa Ana Mountains and the San Joaquin Hills on the south, and the Palos Verdes Peninsula and the Pacific Ocean on the west. The project site is located within the Traverse Ranges Geomorphic Province of Southern California. The Traverse Ranges are characterized by east-west trending structural elements including linear topography, faulting, and folding.

The project site is in the Downey Plain, just north of the Huntington Beach Mesa in the central block of the Basin. The Downey Plain is a broad synclinal sag, 10 to 14-miles wide, covered by tens of thousands of feet of sedimentary rocks. These rocks are Cretaceous[6] to Pleistocene[7] in age and are of both marine and non-marine origin. The Huntington Beach Mesa, which consists of interbedded clay, silt, and gravel with a thickness of 100 to 300 feet, is exposed less than one mile from the site. Geologic conditions within the City of Huntington Beach are characterized as lacking bedrock exposure and consisting of Quaternary deposits (Pleistocene and Halocene[8]). The older deposits are exposed on the mesas and in the perimeter bluffs. The areas of these deposits are classified as older alluvium or terrace materials of the Lakewood and San Pedro formations.[9] The mesas are surrounded and separated by younger alluvium, which is divided into river floodplain deposits and tidal flat/lagoonal type deposits.

The site lies at an elevation of approximately 25 feet above mean sea level and is relatively flat with little topographic relief. The Ocean View Flood Control Channel bounds

[6] *65,000,000 to 140,000,000 years.*

[7] *11,000 to 1,000,000 years.*

[8] *0 to 11,000 years.*

[9] *Huntington Beach General Plan EIR, July 5, 1995.*

portions of the project site to the north, and the Ocean View Channel is located approximately 2,500 feet northwest of the project site. The Santa Ana River is located approximately 3.8 miles east of the project site. Site drainage trends to the north.

b. Soils

Sand with a thickness of approximately 0.5 to 2.5 feet was encountered below the paved sections of some of the site borings in Area A of the project site. The fill represents the subgrade material used for pavement construction. Other fill soils may also exist in portions of the site where field investigation work was limited due to the presence of existing structures. The soil deposits encountered in the borings below the fill/subgrade are alluvial deposits comprised mainly of layers of clay with interbedded sand layers to approximately 15 to 20 feet below ground surface (bgs). The clays range from low to high plasticity and contain varying amounts of fine to medium grained sand. The clayey soils at the site vary from firm to very stiff. Below 20 feet bgs, the soil is predominantly sand with interbedded clay layers. The sandy soils at the project site are predominantly fine grained with occasional pockets containing some medium- to coarse-grained material, varying from medium dense to dense. Groundwater was encountered in some locations within Area A at depths of 25 feet bgs. Groundwater elevations are expected to fluctuate seasonally and may be fed by the infiltration of surface water in the surrounding area. Based on available data and historical groundwater elevations, the expected depth range for the project site groundwater table is 20 to 25 bgs.

The local subsurface conditions of Areas B1 and B2 were not specifically addressed in the geotechnical study, although it can be reasonably assumed that the soil conditions in these areas are similar to Area A. Nonetheless, areas requiring structural improvements or the addition of new structures would require subsequent site-specific soil investigations prior to grading operations.

c. Seismicity

(1) Faulting and Ground Shaking

The City of Huntington Beach is located in the seismically active region of Southern California. Several active and potentially active faults are present in the general project vicinity. Refer to Figure IV.C-1, Major Regional Faults, on page 102 for an illustration of the major surface faults in the region. The nearest active fault to the project site is the North Branch of the Newport-Inglewood Fault Zone, which is located approximately 2.5 miles south of the site. The State Mining and Geology Board defines an "active" fault as one which has demonstrated surface displacement (relative movement in any direction) during the Holocene epoch and which therefore possesses a relatively high potential for future surface rupture. The Newport-

Inglewood Fault is a light-lateral, northwest trending fault system extending approximately 44 miles between Newport Beach on the south and Beverly Hills on the north. Historically, numerous strong earthquakes have occurred along the Newport-Inglewood Fault Zone. The largest and most destructive of these events was the 1933 Long Beach Earthquake, which displayed a magnitude of 6.3. The maximum credible earthquake (MCE) expected to occur on the Newport-Inglewood Fault has a moment magnitude of 6.9. The expected (average) amount of surface fault rupture on any given surface fault trace for the maximum probable or maximum credible earthquake ranges from zero to approximately one foot for magnitudes under 6.0, and from one foot to ten feet or more for magnitudes between 6.0 to 7.5.[10] Other faults in the project vicinity include the Sierra Madre Fault, the Raymond Fault, the Hollywood Fault, and the Verdugo Fault. A list of the faults within a 62-mile radius of the project site, along with their maximum moment magnitude, is provided in Table IV.C-1 on page 103.

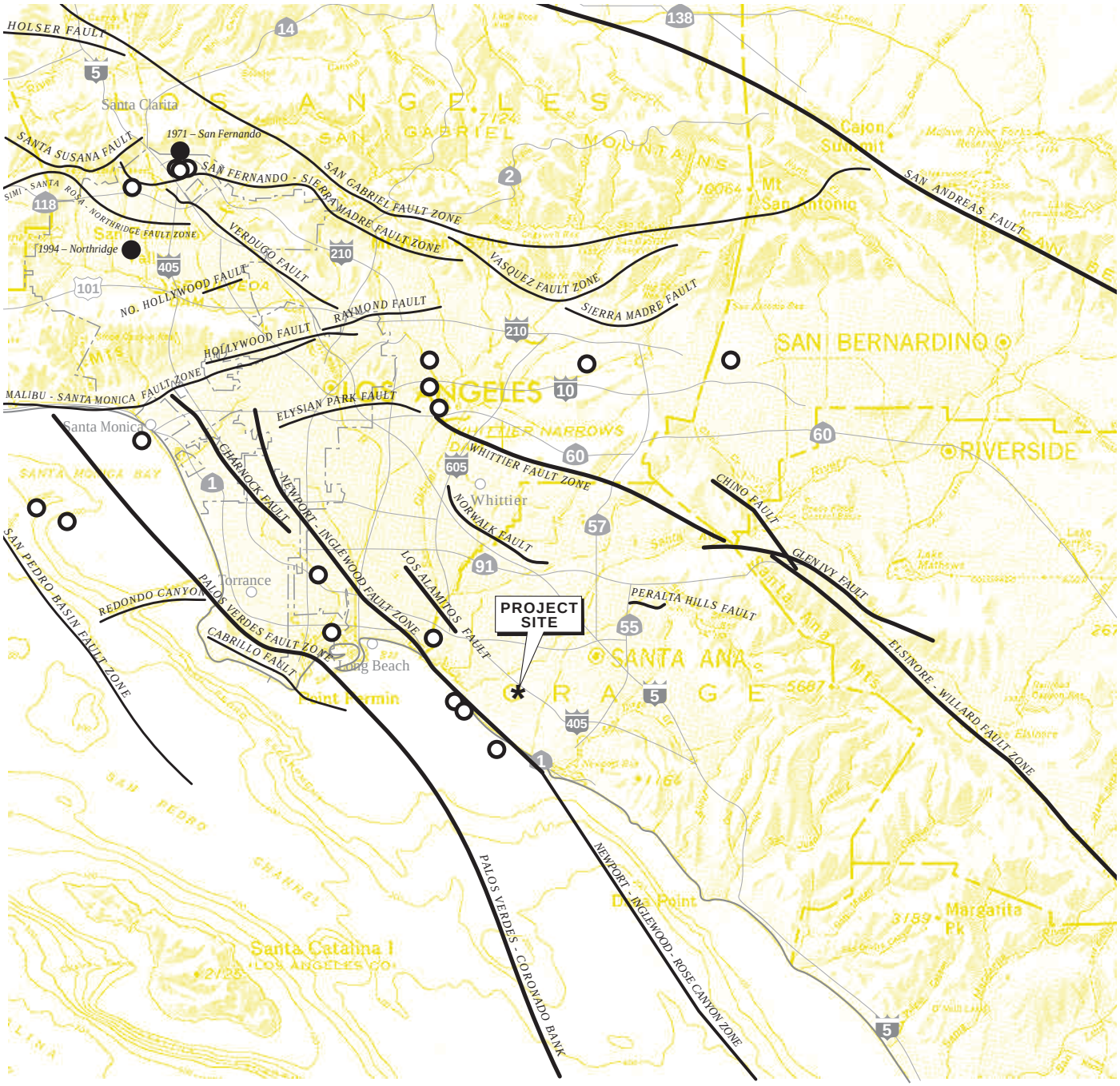
Evidence of active faulting was not observed at the site and no known active or potentially active faults trend toward or pass directly beneath the site. In addition, the project site is not located within an Alquist-Priolo Earthquake Fault Zone.[11]

(2) Other Seismic Conditions

Seismic hazards other than ground shaking and faulting include liquefaction, settlement, tsunamis, seiches, surface rupture, landslides, and seismically induced flooding. Liquefaction is a phenomenon in which saturated, cohesionless soils undergo a temporary loss of strength during severe ground shaking and acquire a degree of mobility sufficient to permit ground deformation. In extreme cases, soil particles can become suspended in groundwater, resulting in the soil deposit becoming mobile and fluid-like. The City of Huntington Beach is underlain by shallow, near surface water, which poses some potential for liquefaction within depths of 0 to 50 feet, and hazards to construction within depths of 30 feet. The mesa areas of the City are characterized by water depths of 10 feet to greater than 30 feet within the older alluvium. The California Division of Mines and Geology has classified the project site as an area of potential liquefaction hazard. In addition, the project site is located within an area categorized in the City's General Plan as having a "high to medium potential" for liquefaction. As indicated in the geotechnical report, liquefaction could occur in sand layers located at a depth of 35 to 50 feet bgs. However, lateral spreading is not expected due to the absence of a nearby slope or free face.

[10] *Huntington Beach General Plan EIR, July 5, 1995.*

[11] *Alquist-Priolo Earthquake Fault Zones, which have been established throughout California, identify areas where potential surface rupture along a fault could prove hazardous. Such zones also identify where special studies are required to characterize hazards to habitable structures.*



Major Earthquake Epicenters

- 6.0 to 7.0 Magnitude
- 5.0 to 6.0 Magnitude

PCR

N

0 5 10 Miles

Source: USGS 1999 Data 1994 Fault Activity DMG
Open-File Report by C. Jennings and PCR Services Corp., July 2000

Figure IV.C-1
Lowe's Home Improvement Warehouse
and Northeast Corner of
Beach Boulevard/Warner Avenue
Major Regional Faults

Table IV.C-1

FAULTS WITHIN A 62-MILE RADIUS OF THE PROJECT SITE

Fault	Distance to Site (Miles)	Magnitude (M_{max}) [a]
Sierra Madre (San Fernando) Fault	4	6.7
Raymond Fault	5	6.5
Newport-Inglewood Fault	10	6.9
Hollywood Fault	15	6.4
Verdugo Fault	15	6.7
Cucamonga Fault	16	7.0
Elsinore (Whittier) Fault	20	6.8
San Andreas Fault (1857 Rupture Segment)	26	7.8
Palos Verdes Fault	29	7.1
Elsinore (Glen Ivy) Fault	29	6.8
San Jacinto (San Bernardino) Fault	30	6.7
San Gabriel Fault	37	7.0
Malibu Coast Fault	38	6.7

[a] *M_{max} = Maximum moment magnitude.*

Source: Golder Associates, February 2000.

Settlement occurs when loosely consolidated materials and fill collapse into soil pore space under the weight of structures. The soils underlying the project site are medium dense to dense, meaning they are less prone to major settlement. A seismic hazard analysis was performed to evaluate the potential for ground settlement and/or liquefaction resulting from strong ground motion from an earthquake occurring near the site. In accordance with guidelines contained in the Uniform Building Code (UBC) of 1997, the ground motion peak horizontal ground acceleration (PHGA) used for analysis corresponds to a seismic event that has no more than a 10 percent chance of exceedance in a fifty (50) year design life. This ground motion corresponds to an earthquake with a magnitude between 6.5 and 7.0 near the site.

As previously discussed, no evidence was found that any faults trend toward or traverse the site, and the site is not located within an Alquist-Priolo Special Studies Zone. Therefore, the likelihood of surface rupture is considered low.

A seismic seiche is an oscillation of a body of water in an enclosed or semi-enclosed area resulting from an earthquake. A tsunami is a large ocean wave produced by an undersea disturbance, such as an earthquake. Seiches and tsunamis are not expected to be a concern due to the site's distance from large, land-locked bodies of water and from the Pacific Ocean, which is approximately 3.5 miles from the site. Furthermore, the site lies at approximately 25 feet above mean sea level, further reducing the potential for tsunami effects.

Landslides are typically associated with slope instability or earthquake induced ground movement that occurs in proximity to steep canyons or hillsides. As the topography of the land in the project area is generally flat and no slides have been known to occur on the site in the past,

landslides are not expected to pose a threat. Seismically induced flooding is also not expected, as there are no significant water bodies on or upstream of the project site.

The local seismic conditions of Areas B1 and B2 were not specifically addressed in the geotechnical report. However, seismic hazards associated with ground shaking, faulting, tsunamis, seiches, surface rupture, landslides, and flooding that apply to Area A would also likely apply to Areas B1 and B2, as the distance from the Newport-Inglewood Fault, as well as from any water bodies, is essentially the same. Therefore, similar conditions would exist. Conditions associated with liquefaction and the settlement of soils could vary and would, therefore, require site-specific analysis prior to development of Areas B1 and B2.

3. ENVIRONMENTAL IMPACTS

a. Significance Thresholds

A significant impact would be identified if the proposed project is determined to:

- Be inconsistent with adopted plans and policies; or
- Result in the exposure of people or structures to major geologic hazards that cannot be overcome by design using reasonable construction and/or maintenance measures.

b. Project Level Impacts

(1) Grading and Site Design

The project involves the development and intensification of Area A with commercial/retail, restaurant uses and associated surface parking and landscape areas. The geotechnical report included as Appendix C of this document analyzes the potential impacts associated with the construction of the proposed development. This analysis concluded that the project could be designed using conventional shallow foundations supported on recompacted on-site and imported soils. As the site is relatively flat and has been previously paved, construction of the proposed project would not cause or accelerate mudflows or landslides. With implementation of appropriate construction techniques, project construction would result in less than significant impacts associated with unstable soil conditions. All site preparation and earthwork operations would be performed in accordance with applicable State and City building codes and would comply with City permitting and construction inspection procedures. As such, the project would result in less than significant impacts to geology and soils related to grading and site design.

(2) Seismic Hazards

The potential seismic hazards associated with the proposed project consist of ground shaking and earthquake-induced ground failure, including liquefaction and settlement. The potential for any of these hazards depends upon the severity of the ground shaking at the project site. These potential hazards are discussed below.

(a) Ground Shaking

In the event of a seismic occurrence, the level of ground shaking that would be experienced at the project site would be typical of the Southern California region as a whole. Ground shaking impacts at the project site are considered to be moderate to high due to the proximity of known active faults within the region.

The proposed development would be designed in accordance with the requirements of the UBC of 1997 for Seismic Zone 4. Adherence to UBC requirements, as well as compliance with State and City building and seismic regulations and implementation of Mitigation Measure GS-1 below, would ensure that potential impacts associated with the exposure of on-site populations to seismic hazards in all areas of the project site would be reduced to the extent possible and would be less than significant.

(b) Earthquake-Induced Ground Failure

As previously discussed, the California Division of Mines and Geology and the City's General Plan have identified the project site as an area of potential liquefaction hazard. As indicated in the geotechnical report, total seismic settlements are expected to be approximately 2.8 inches. Given the depth at which these settlements could occur (i.e., 35 to 50 feet bgs) and their confinement by overlying clay layers, it is anticipated that differential settlement should be on the order of 50 percent of the total settlement or 1.4 inches between adjacent columns. Differential settlement of this magnitude would not be expected to affect the structural performance of proposed buildings. However, assessment by a structural engineer is recommended once foundation and column layout is complete. Specific measures may be recommended, and implementation of standard design and construction measures would reduce the potential for structural damage or safety concerns related to liquefaction. As such, impacts associated with liquefaction and seismic settlement would be less than significant.

(3) Soil Hazards

The potential non-seismic hazards associated with the proposed project consist of expansive soils. As previously discussed, the soil deposits encountered in the borings below the

existing fill/subgrade were alluvial deposits consisting mainly of layers of clay with interbedded sand layers to approximately 15 to 20 feet bgs. The clays ranged from low to high plasticity and contained varying amounts of fine to medium grained sand. The clayey soils at the project site varied from firm to very stiff. Certain clay minerals have the potential to expand when wetted. Therefore, there is the potential that expansive soils are present on the project site. Based on the geotechnical report, it is feasible to construct the proposed development as planned, provided that specific design recommendations are incorporated into the project design and construction. With implementation of such measures, such as subgrade drainage, impacts associated with expansive soils would be less than significant.

c. Program Level Impacts

While the potential for geology and soils-related impacts associated with improvements in Area B1 are not analyzed in detail in the geotechnical investigation, it is expected that potential impacts similar to those that could occur in Area A would exist for future development that might occur in Area B1. Since no new development is proposed for Area B2, no impacts associated with that portion of the site would occur. Site-specific analysis for Area B1 would be conducted prior to grading activities. Any construction in Area B1 would be in accordance with the California Division of Mines and Geology Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California (1997). Furthermore, site-specific soil analyses would be required prior to development in Area B1. It is expected that adherence to UBC requirements, compliance with applicable City and State requirements, and implementation of the mitigation measures outlined below would reduce any potential impacts associated with this area to a less than significant level.

4. CUMULATIVE IMPACTS

Geologic and soil impacts related to the proposed project are site-specific and would not have the potential to combine with impacts of other related projects to result in cumulative impacts. Furthermore, each related project would be required to comply with applicable requirements for site design, grading, and construction, as well as with project-specific geotechnical recommendations by certified geologists.

5. STANDARD CITY POLICIES AND REQUIREMENTS

The project will be required to comply with standard conditions of approval which reduce impacts to geology and soils as follows:

1. Submittal of building plans that incorporate the applicable requirements of the Uniform Building Code related to construction in Seismic Zone 4.

2. Prior to issuance of grading permits for all areas of the project site, the applicant shall coordinate with the Department of Public Works, Transportation Division, in developing a haul route plan for removal and import of materials. This plan shall be submitted to the Department of Public Works for review and approval.

3. Prior to issuance of grading permits for Area A of the project site and ongoing throughout construction, on-site activities shall comply with development, grading, and building standards set forth in the City's Municipal Code and in the Uniform Building Code.

4. Prior to issuance of grading permits for Area B1, a site-specific soils analysis shall be submitted to the Departments of Building and Safety and Public Works for review and approval.

5. Prior to issuance of grading permits for Area B1 of the project site and ongoing throughout construction, on-site activities shall comply with development, grading, and building standards set forth in the City's Zoning and Subdivision Ordinance and in the Uniform Building Code.

6. LEVEL OF SIGNIFICANCE BEFORE MITIGATION

Project-related impacts with respect to earth resources would be less than significant.

While there is minimal potential for non-seismic ground failure, potential impacts could be significant without the implementation of the recommendations in the geotechnical report.

The exposure of people to seismic hazards is typical of most development in Southern California. Potential impacts are less than significant due to project compliance with existing building codes and regulations.

7. MITIGATION MEASURES

a. Project Level

GS-1 Prior to issuance of grading permits for all areas of the project site, grading and site plans prepared by a licensed civil engineer shall be submitted to the Departments of

Building and Safety and Public Works for review and approval. Such plans shall define the grading, excavation, and placement of fill on the project site, and shall incorporate the recommendations contained in the geotechnical report contained in Appendix C of the EIR**.**

8. LEVEL OF SIGNIFICANCE AFTER MITIGATION

The proposed project would not result in a significant impact with respect to geology and soils with implementation of Mitigation Measure GS-1.